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Performance, Organ Relative Weight, Serum and Haematology Parameters in Broiler Finisher Fed Biodegraded Brewers Dried Grain

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Abstract: Four isonitrogeneous diet made up of Brewer's dried grain with a control diet was distributed at the rate of 9 birds per replicate and three replicates per diet in a completely randomized design experiment. Fungal biodegradation of brewers dried grain (BDG) resulted in improved nutrient composition of the by-product. The effects of feeding biodegraded BDG on relative organ weight, serum and heamatological parameters and economy of broiler finisher were investigated. Although no significant difference was observed in the feed intake of broiler finisher fed the graded levels tested but significant difference ($P< 0.05$) was observed in the rate of weight gain (g/day). Feed cost per kilogram was lowest on diet 4 but feed cost per weight gain (N/g) gave a value of 10.60 and 7.32 on diet 4 and 2 respectively. Biodegraded BDG at 20% inclusion level gave the highest weight gain 1213.73 over 28 days and the lowest weight gain of 668.51g on diet 4. Weight of gizzard and liver significantly increased with inclusion of BDG a weight range of 2.50 to 3.30% and 1.59-2.59% respectively of the total weight. The serum urea increased significantly across the graded levels tested (24.50-42.50g/dl), but the serum globulin content on the other hand decreased with values range between 3.05-3.40g/dl. The utilization of biodegraded BDG beyond 30% level in broiler finisher is not encouraging but the best result was obtained at 20% level of biodegraded BDG.

Key words: Biodegraded BDG, feed ingredients, livestock production, broiler feeding

Introduction

The scarcity and escalating cost of unconventional feed ingredients have adversely affected the livestock production in Nigeria. In view of this, efforts have been geared towards search for the readily available alternative source of livestock feed ingredients.(Arowora and Tewe, 2003). Some of these are Brewer's dried grain (BDG), Rice husk (RH), Maize offal and palm kernel meal.

The utilization of fibrous feed ingredient as alternative feed stuffs in broiler production is not new but the inclusion level at various ages and physiological conditions varies. The work of Bolarinwa (1999) studied the preference of farmers to different agro-industrial by-products (AIBs) and the maximum tolerance level in broilers diets, while Onifade (1993) reported on graded level of some agro-industrial by-product and ways of improving their utilization. The maximum tolerance level of BDG as stated by Ademosun (1973) is 10% but Varel *et al.* (1987) asserted the use of 20% AIBS in adult birds.

Ingestion of numerous dietary components has been found to have measurable effort on some blood constituent (Church *et al*., 1984, Fashina, 1991). Therefore blood provides a valuable medium for clinical investigation of nutritional status of individual.

This study reports the effect of inclusion of high levels of biodegraded BDG on the economic performance, serum heamatological and carcass parameters in broilers finisher production.

Materials and Methods

Brewers dried grain (BDG) was biodegraded with *Trichoderma viridii* according to the procedure outlined by Iyayi and Aderolu (2004). The biodegradation lasted for 10 days. One hundred and eight, four week old broilers were allotted in a complete randomized design to four experimental diets (19%CP) at the rate of 9 birds per replicate and 3 replicates per diet.

The composition of the diets is shown in Table 1 while Table 2 shows the chemical composition of the ingredients and experimental diets. The control diet had 20% BDG while diets 2, 3 and 4 had 20, 30 and 40% biodegraded BDG respectively.

Routine vaccination and other management practices were adhered to. Records of body weights and feed consumption were kept on a weekly basis. Data on economic of broilers production based on prevailing prices as at experimental time period were also computed.

At the end of the 9th week, the birds were starved for 18hr and then killed by decapitation. Approximately 10ml of fresh blood was collected; 5ml for biochemical analysis while the other part was poured in blood bottle containing measured quantities of (EDTA) anticoagulant for hematological analysis. Heamatological parameters

Table 1: Gross composition of experimental diets for broiler finisher using Brewer's dried grain

	20%U	20%T	30%T	40%T
Ingredients	1	2	3	4
Maize	53.00	62.20	59.20	52.50
Soya bean meal	15.50	6.30	0.00	0.00
Brewers dried grain	20.00	20.00	30.00	40.00
Fish	4.00	4.00	3.30	-
Palm Oil	4.00	4.00	4.00	4.00
Bone	2.30	2.30	2.30	2.30
Oyster	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00

*Composition of Premix Vitamin mineral premix supplied the following vitamins and minerals. Per Kg diet Vit. A, 8,000 I.U, Vit. B_3, 1800, Vit. E, 12I.U, I.U, Vit. K, 2.2g, Vit. B_1, 1.55g, Vit. B_2, 5.0g, Vit. B_6, 2.35g, Vit. B_{12}, 13mg, biotin 42mg, niacin, 23g, Pantothenic acid, 6.5g, Folic acid, 0.65g, U - undegraded BDG, B – Biodegraded BDG

Table 2: Proximate and Detergent fibre analysis of test ingredients and diets

Parameters	UBDG	TBDG	DIET 1	DIET 2	DIET 3	DIET 4
Dry Matter	90.01	89.54	88.97	87.47	89.26	89.14
Crude Protein	21.60	36.32	18.79	18.64	18.38	18.26
Crude fibre	20.00	15.50	9.39	9.25	11.92	2.63
Ether extract	7.20	4.00	5.07	5.03	5.23	6.14
Ash	18.60	14.10	7.1	7.06	7.14	7.22
Nitrogen free extract	32.60	30.08	59.64	60.02	57.33	55.75
Neutral detergent fibre	65.73	51.67	40.19	39.49	41.40	42.48
Acid detergent fibre	29.13	22.41	12.48	12.08	12.97	13.09
Hemicellulose	36.60	29.26	5.29	5.05	5.97	6.17
Acid detergent lignin	2.50	2.42	27.71	27.41	28.43	29.39
Cellulose	26.63	19.99	7.19	7.03	7.00	6.92

Table 3: Economy of production of broiler finisher based on graded levels of Brewers dried grain

	Brewers dried grain				
	20%U	20%T	30%T	40%T	
Parameters	B_1	B_2	B_3	B_4	S.E.M
Cost of 35 day old chicks (**x**)	164.32	165.92	161.84	145.60	
Feed intake (g/bird/day)	153.96	153.83	158.45	141.29	7.79
Total feed consumed (g)	2014.43	2009.46	2082.02	2076.98	
Feed cost/kg (**x**)	43.84	44.22	40.30	34.13	
Total cost/chicken (**x**)	252.62	254.82	245.74	216.50	
Final body weight (g)	2011.50[a]	2109.00[a]	1766.50[b]	1449.50[b]	54.50
Initial body weight (g)	889.74	895.27	874.76	780.99	
Body weight gain (g)	1121.76	1213.73	891.74	668.51	
Feed cost/gain (**x**/g)	9.92	7.33	9.41	10.61	
Economic ranking	3	1	2	4	

were determined as follows: Packed cell volume (PCV), red blood cell counts (RBC), white blood cells (WBC) and haemoglobin were determine using Wintrobes microhaemaatocrit and improved Neubauer haemocytometer and Cynomethaemoglobin methods respectively, erythrocytic indices, namely, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular haemoglobin (MCH) were derived as outlined by Jain (1986). The serum metabolite protein,

Table 4: Relative organ morphometry of broiler finisher fed graded levels of Brewers dried grain

	Brewers Dried Grain				
Parameters	20% U B_1	20% T B_2	30%T B_3	40% T B_4	S.E.M
Crop (%)	0.735[a]	0.785[a]	0.885[a]	0.975[a]	0.087
Proventiculus (%)	0.76[a]	0.66[a]	0.66[a]	0.61[a]	0.069
Gizzard (%)	2.875[ab]	2.495[b]	2.905[ab]	3.325[a]	0.144
Small Intestine weight (%)	2.49[b]	2.77[b]	3.83[a]	3.08[b]	0.173
Large intestine weight (%)	0.16[a]	0.15[a]	0.20[a]	0.19[a]	0.023
Caecum (%)	0.53[a]	0.57[a]	0.75[a]	0.64[a]	0.104
Heart (%)	0.545[a]	0.485[a]	0.485[a]	0.555[a]	0.040
Liver (%)	1.52[c]	2.35[b]	2.59[a]	2.43[ab]	0.058
Spleen (%)	0.10[c]	0.18[b]	0.24[b]	0.12[c]	0.012
Abdominal fat (%)	0.99[a]	0.83[c]	0.35[d]	0.91[b]	0.023
Small Intestine length (cm)	211.60[a]	199.50[a]	198.10[a]	195.50[a]	5.774
Large Intestine length (cm)	11.10a	9.50[a]	12.50[a]	8.01[a]	2.309

a, b, c, d means within the same row with difference superscripts are significantly difference ($p < 0.05$)

total albumin, globulin cholesterol glucose and urea were determined as described by Kaneko (1989).

The birds were then dressed, weighed before the gastro intestinal tract (GIT) of each bird was quickly removed and weighed. This was followed by weight of empty crop, proventiculus, gizzard, the large and small intestines, caecum and heart. Others were the spleen, abdominal fat and liver. The weights of organs were expressed relative to the respective body weight of the birds. The lengths of the small and large intestines were also recorded.

Statistical analysis: All data generated were subjected to one-way analysis of variance using the S. A. S statistical package and the treatment means of each variable were separated using the Ducan Multiple range test (Steel and Torrie, 1980).

Results

Performance: Feed intake did not differ among birds fed graded levels of undegraded and biodegraded BDG (Table 3). The growth rate between the control and 20% biodegraded BDG were similar while between the 30 and 40% levels of biodegraded BDG no significant level was equally observed. The feed cost 1 gain ratio was only significantly different on diets 4 although diet 2 had the best value highest on diet 4 and lowest on diet 2 according to the economic ranking.

Relative organ morphometery: There were no significant differences ($p>0.05$) in the weight obtained for the crop, proventiculus, large intestine, caecum and heart. The large and small intestine were not also significantly different across the different levels of the test ingredient, (Table 4).

Weight of gizzard was lowest on diet 2.495% while diet 4 had the largest value 3.325%. Weight of liver increased as the level of BDG increased while the control diet had the highest value for abdominal fat (0.99%).

Haematological and serum biochemical parameters: Table 5 shows the treatment means for some haematological and serum biochemical parameters investigated. The values obtained for the packed cell volume haemoglobin and mean corpuscular haemoglobin were not significantly different between the control and other diets.

Among the biochemical parameters studied, significant differences were only observed for globulin and urea. The globulin value decreased as BDG in the diets increased.

Discussion

Biodegradation conferred on the BDG improved nutritional composition, with an improvement in crude protein value by 68.15%. Belewu and Okhawere 1998, Iyayi and Aderolu *et al.,* 2004 had earlier obtained this type of result.

Birds are known to increase their feed intake when the energy and protein values are diluted but the extent to which this can be done is checked by the capacity of the gut.

The quality of the feed understudy decreases as the level of the test ingredient increases. Although all the diets has 19% crude protein but the quality of the protein differs as well as the crude fibre and detergent fibre composition of the diets also varies. Reasons why feed intake was not significant, could be due to gut filled effect, gritty nature of the feed along the graded levels tested and probably due to the fact that birds on higher fibre diet consumed more water than feed as observed during the experiment.

Rate of weight gain has to do with the nutrient supplied. Although the feed intake is similar but the quality of the

Table 5: Haematological and serum biochemical parameters of broiler finisher fed graded levels of brewer's dried grain

	Brewers dried grain				
	20% U	20% T	30% T	40%T	SEM
PVC (%)	25.00[ab]	19.50[b]	26.50[a]	19.50[b]	1.98
HB (g/dl)	8.30[ab]	6.50[b]	8.80[a]	6.45[b]	0.66
RBC (x 10^6/l)	2.15[a]	1.50[b]	2.30[a]	1.40[b]	0.17
WBC x $10^{3/1)}$	18950[a]	27300[a]	19950[a]	18200[b]	138.15
MCV (fl)	116.52[c]	129.91[b]	115.16[c]	139.59[a]	2.62
MCH (pg)	38.70[b]	43.31[a]	38.24[b]	46.15[a]	0.900
MCHC (%)	33.21	33.33[a]	33.21[a]	33.06[a]	0.13
Urea (ng/dl)	24.50[c]	28.00[bc]	42.50[a]	31.50[b]	1.50
Total Protein (g/dl)	6.30	6.15[a]	6.20[a]	6.10[a]	1.13
Albumin (g/dl)	2.90	2.95[a]	3.05[a]	2.95[a]	0.08
Globulin (g/dl)	3.20[a]	3.1[b]	3.15[c]	3.05[d]	
Arginine (g/dm)	0.95	0.92[a]	0.96[a]	0.93[a]	0.02
Cholesterol (g/dl)	142.50	145.00[a]	129.50[a]	157.00[a]	10.23
Triglyceride (mg/dl)	114.00	96.00[a]	113.00[a]	115.00[a]	9.06
Glucose (mg/dl)	1229	125.00[a]	124.00[a]	121.50[a]	3.71

[abcd]Means in the same row with different superscripts are significantly different ($P < 0.05$).

nutrient offered varies. The quality of protein been fed has a lot to do with the essential amino acid required for growth. Animal protein source and quality of protein generated from soybean meal cannot be compared to the single-cell protein as supplied by the fungi biodegradation process.

Feed conversion efficiency become poorer with corresponding incremental levels of fibre. This according to Ander (1992) and Nir *et al.* (1994) may have to do with alteration in texture, colour, taste and odour of the diets. Feed consumption and ultimately utilization may be affected by each of the above factors independently or in combination, (Odunsi *et al.,* 1996). The above reasons could probably account for the performance of birds on higher BDG levels.

The effect of feeding different dietary fibres sources on body weight and empty gastro intestinal weight is well documented by Staniogias and Pearce (1985), Pond 1989 and Onifade (1993).

According to Olorede (1998) weight of crop is expected to increase at graded level of dietary fibre but no significant difference was obtained in this study. This may have to do with the non significant difference obtained in the feed intake value. The gizzard weight is expected to also increase due to more work to blend the fibre ingested (Deaton, 1977 and Onifade, 1993). The above reason probably explained why birds on diet 4 had the biggest weight of gizzard.

Excess energy supplied to animal could be stored in form of fat. The addition of fibre to the diet caused a dilution in feed energy content and this explained why birds on diet one had more abdominal fat.

The hyperthropy noticed in the spleen and liver with increased BDG levels a metabolic response to impoverished diet which result in higher physiological activities by these organs and from the efficiency of conversion of animal feed to tissue, this may have a considerable negative effect (Low, 1989). The implication of the above is that dietary nutrients are diverted from the growth of edible carcass to the accretion of intestinal and visceral organs.

According to Thorburn and Wilcox (1985) structural carbohydrates in monogastric diets have specifically a mechanical effect on intestinal wall. At high fibre level gastro-intestinal tract increase and thicken. The above explanation probably account for the observed result of the weight of the small intestine.

Although Babatunde and Pond (1987) stated that heamatological traits correlate well with nutritional status and performance of the animal in this study no regular pattern was observed in the haemotological parameters obtained. The serum cholesterol values obtained were within the range of 115±29 to 152 ±2.0mg/dl for non-laying bird reported stated by Leville *et al.* (1957). The above result attests to the fact that substitution between soyabean meal, fish meal and microbial protein from biodegradation process could not be done absolutely.

Reduction in globulin and glucose values is an indication of malnutrition, this is evident at higher inclusion level of biodegraded BDG as no significant difference was found in the feed intake of birds on all experiment diets despite poor quality at higher inclusion level of BDG.

Uric acid which is the primary catabolic product of protein, non protein nitrogen and purines is a good indicator of the quality of protein fed to birds. According to Chandra *et al.* (1983), hyper-uricemia occur in birds

when there is starvation, massive tissue destruction and renal disease.

Serum protein is a function of protein quality and a high urea level is an indication of poor quality protein. The above facts thereby expose the implication of exchange of high quality protein ingredients like soyabean and fishmeal for microbial protein form biodegradation process.

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